ation of inebriates, that it is practicable to combine the needed intellectual, moral and medical treatment, with the necessary seclusion and restraint.

If our system of jurisprudence was so altered that simple voluntary intoxication was recognized as a misdemeanor, subjecting the offender to arrest and proper punishment; and habitual intoxication or confirmed drunkenness a dangerous disability, subjecting the party convicted of the same to legal detention and discipline in a public asylum or institution established for that purpose, it would not only result in restoring a large proportion of the victims of inebriation to sobriety and usefulness, but it would do more to create in the public mind, among all classes of society, a correct idea of the nature and tendencies of intoxicating drinks, than could be accomplished in any other way. Instead of continuing the erroneous belief among the young and laboring classes, that alcoholic drinks are restorative, and in moderate quantities beneficial; and that a convivial spree now and then is only a harmless indulgence, it would practically and indissolubly connect the use of intoxicants with the idea of physical and mental impairment, social degradation and final disability—a result which would be in strict accordance with the truths of science and the interests of humanity.

ART. VI.—ON CEREBRAL ANÆMIA.

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"IN anæmia of the brain that comes on slowly, just as in hyperæmia, at first there are usually symptoms of irritation, subsequently those of paralysis. To explain this correspondence, the hypothesis has been advanced that a certain tension of the molecules of the brain is necessary for its normal activity, and that an increase or a decrease of this tension, by too great or too slight a fullness of the vessels, modifies the excitability of the brain in the same way. I have already said

that this is a hypothesis, and I may add, that it is difficult for me to believe that, in anæmia of the brain, the symptoms of irritation depend on an inconsiderable, and those of paralysis on a decided, diminution of the normal pressure of the blood-vessels on the brain. On the other hand, it is a physiological fact that the excitability of a nerve is increased a short time before it is entirely lost, and that the greatly increased excitability of a nerve is not the sign of increased normal nutrition, but, on the contrary, of its diminution."—Niemeyer, Vol. II., pp. 172-3.

"The symptomatic manifestations of hyperæmia and anæmia being identical, furnish no clue by which we can recognize and differentiate two pathological conditions diametrically opposite in character."—Baudry, p. 60.

The above quotations express the subject of this paper in the clearest manner, and moreover show that no explanation of the facts has been offered hitherto, of a satisfactory character. In my humble opinion the cause of this is to be found in two circumstances: first, that the investigation into the nature, growth, development, functions and relations to the outside world, of the nervous system, has not been carried as far as our present knowledge will admit; while in the second place, the profession has not yet cleared itself of the old metaphysical views and their consequences, but blend in a sort of hodge-podge, two lines of thought essentially different, often diametrically opposite in their tendencies. If the explanation here offered be correct, it will relegate the subject to more extended clinical observation, the difficulties being in diagnosing anæmia from hyperæmia in a hyperæmic person, or hyperæmia from anæmia in one that is generally anæmic—conditions in which a consideration of the general symptoms would only mislead, the local circulation and the general circulation being in different conditions. In presenting the argument it is necessary to show in as brief a manner as possible, the foundations on which it rests, before the conclusions arrived at can be determined as correct or otherwise.

1. The essential part of the nervous system is the neurine; this forms the contents of the nerve cells, and the axis cylinders of the nerve fibres. In the natural state it is semi-fluid, exceed-

ingly unstable in its character, of high atomic composition, and is surrounded by a non-conducting protective sheath.

2. The function of the neurine is to transmit the so-called "nerve force;" this transmission is accomplished by means of movements in the molecules of the neurine; the wave of force finds these molecules in a state of rest; excites movements among them, and passing on, leaves them again in a state of rest. If there is no such movement there is no such transmission; the movement and the transmission may therefore be considered identical in their character, so that transmission involves movement, and, *vice versa*, movement involves transmission.

3. "Nerve force" is the continuance or correlate of external forces in its various modes; the fœtal brain has no more power to originate force, than the original cells of the embryo; nor has the infantile brain any such power over that of the fœtus, nor the brain of the adult over that of the infant. The very ideas of self-consciousness which the brain possesses are derived from the impressions produced on it by parts outside it. The different senses are the results of the movements produced in the neurine by the sudden arrest of external movements, whether they be the undulations of light, the vibrations of sound, or the grosser impact of touch—these all carry with them the necessity of motion for their existence and continuance. Remove the undulations of light and there is the rest of darkness; the vibrations of sound, there is the rest of quiet; the impact of touch, there is the rest of repose. The impacts of external forces cease: no correlation is produced, no nerve force is transmitted.

Again, "nerve force" is the correlate of external forces; heat produces sensation; electricity produces sensation; chemical action produces sensation; all of these are but modes of motion, and "things which are equal to the same thing are equal to one another." Substitute the words "correlates of," for the words "equal to," and things which are correlates of the same thing are correlates of one another; therefore, all the modes of force eliminated within the body, or secondarily produced therein, may be correlated into nerve force; or nerve force may be correlated into any of them.

4. The forces of the body are a unit, manifested in different modes. Sensation, ideation, motion (or motor impulse), heat, nutrition, chemical action, and every other mode of force are like the various modes of force in the world around us: protean forms of that force or energy which pervades all matter, and is inseparable from it, giving to the sun his light and heat, to the fields their verdure, to the stars and planets their movements, to the crystal its form and to the brain its *capability for action.*

5. Molecular movements in a line of neurine produce "nerve force" at the terminus of the line, and these movements can be inaugurated at any point of the line; while the form of nerve force so produced will be that peculiar to the line in which these movements occur. The optic nerves and the optic tract produce the sensation of vision and of vision only; the auditory nerves and tract that of audition only; the gustatory nerves that of taste only; the olfactory nerves and tract that of smell only; the sensory nerves and tract produce only sensation; motor nerves and tract only motion; ideational nerves and tracts only ideation. To produce molecular movements the force of the impulse must be sufficient to overcome the *vis inertiæ* of the matter to be moved, or the force is imperceptible; *i. e.*, produces no effect. The various nuclei communicate so freely with some of the others by commissural fibres, that a violent movement in one will affect very many of the others; while a slight movement in one will produce no such perturbation; hence it is that in ordinary conditions we are not thrown into conditions of disorder by, and indeed may take but very slight notice of, events passing around us, while at other times these events may prove sources of extreme annoyance; and movements being set up in nerve tracts, we may have the phenomena of vision and of hearing without any material basis, as in dreams, delusions, etc. Again, if we study the line of the trajectory of force through the system, we find that the impulse becomes a sensation, then a perception, then an emotion, then, reaching the climax of the afferent part of the trajectors, is subjected to the reason, then, passing on the efferent part of the trajectors, becomes will, then motor impulse and movement. But the

force may pass from the afferent to the efferent at many points without traversing the whole route. Thus sensation may become converted directly into motion—so also may perception, etc. Thus, a violent stench produces a sudden start; so does a sudden noise or a sudden appearance of something undefined by vision. The manifestation of any mode of nerve force depends, therefore, on the occurrence of molecular movements in the line of neurine, whose particular function it is to manifest that especial form of nerve force; while, as nerves do not communicate except through nuclei, and as the wave of force will be distributed according to its strength, the effects of an impression, or of a molecular movement wave, depend partly on the nuclear communications and partly on the mobility of the neurine, or rather the degree of movement induced therein.

6. The neurine is preserved in its normal condition of mobility by its nutrition. The oxygen of the blood permeates the neurine, oxidizes and removes part of it, giving rise to a local production of heat which is necessary for its normal existence; the blood plasma supplies the vesicular nucleus or the neurine itself with fresh material by which that which is removed is made good, so that the amount of neurine remains in proper quantity and of proper quality.

7. The nutrition of the neurine and its performance of function are entirely different conditions. The former gives the ability to act—by the latter action is accomplished; the former supplies a thread of neurine with its converted cells, but in a state of rest—during the latter the neurine is thrown into movement throughout its entire length; by the former the neurine is rendered capable of acting—by the latter this capability is lost if the action be long continued, to be restored, if at all, only by nutrition and rest. The neurine receives nutrition during sleep, but if the sleep be complete, no function is performed. Oxygen and blood plasma are the means by which the neurine is nourished; but in addition to these the blood contains much oxidizable material, which being oxidized among the brain cells, gives liberation to considerable force, part of which, commencing as heat, is correlated into "nerve force" by setting up movements on lines of neurine. And this we find as the

result of alcoholic absorption into the blood, or of hyperæmia of the brain, producing the phenomena grouped together under cerebral irritation—the greater or less degree of which depends on the amount of matter oxidized, the amount of heat produced, and the extent of the diffused force waves; while the mode of its manifestation depends on the lines of neurine in which movements are established.

8. When the brain receives less than its due supply of oxygen and plasma, the neurine is but imperfectly freed from those of its molecules which, having long formed part of its substance, have passed through the active period of their existence, and have become ready to be removed; while the plasma being deficient, the nuclei are unable to replace the matter removed with fresh material of the proper quality, and, as always occurs in the condition of anæmia, the neurine becomes more watery than it should naturally be, and notably more mobile in its character. If the worn out matter is not removed from the neurine as rapidly as it is formed, it accumulates, and absorbing part of the oxygen gives rise to the formation of compounds which ought not to be formed, gradually causing the tissue to be completely modified and to be no longer fit for its original purposes. The formation of these compounds occasions molecular movements during the re-arrangement of the particles; and thus we find that the very beginning of failure in oxidation and replenishment gives rise to phenomena resembling in their manifestations those produced by the institution of molecular movements from opposite causes. The internal re-arrangement of the constituent matter of the neurine goes on, molecular movements go on, phenomena of irritation are manifested, until at last the neurine becomes so changed in its composition that movements cease in it, and the result is paralysis of sensation, of ideation, and of motion, rapidly ending in death.

The neurine is not by any means a good conductor of force, the rate of conduction being only about one hundred feet in a second of time. Yet we find this mobility increased by heat, so that the rate reaches over two hundred and fifty feet in a second, and decreased by cold so that it becomes *nil*. During those primary changes which must necessarily occur in the neurine

in consequence of a failure in its nutrition, portions of the combined force of the neurine become liberated and waves of force are originated, producing manifestations of phenomena similar to those produced by waves of force originated by other causes; while the afferent nerves are conducting waves of force from the periphery to the centre in their usual manner.

The disturbances of function resulting from these abnormal waves of force will depend on the distribution of such waves, and they will be accordingly sensory, ideational, or motor, and they may also involve the processes of animal life, such as digestion, respiration, circulation, and nutrition and secretion generally—which are especially under the control of the sympathetic nervous system—the extent of the disorder depending on the degree of force distributed.

In offering the above as an explanation of the similarity of phenomena manifested by two such different conditions as hyperæmia and anæmia, the author is aware that the argument is based on analogy and induction altogether. It is possible that the sphygmograph might furnish much additional information, the ophthalmoscope not being of the value that it was expected to be. An anæmic person may have paresis of the vaso-motor nerves of the cerebral vessels, and consequently cerebral hyperæmia; while a hyperæmic person may have irritation of those nerves, and consequently contraction of the cerebral vessels and cerebral anæmia. In each of these cases the local circulation through the brain, and the general circulation, will be in opposite conditions; yet in each the nucleus of the vagus will be more or less affected, though in a different manner, and such affection may give its traces either by the cardiograph or the sphygmograph.